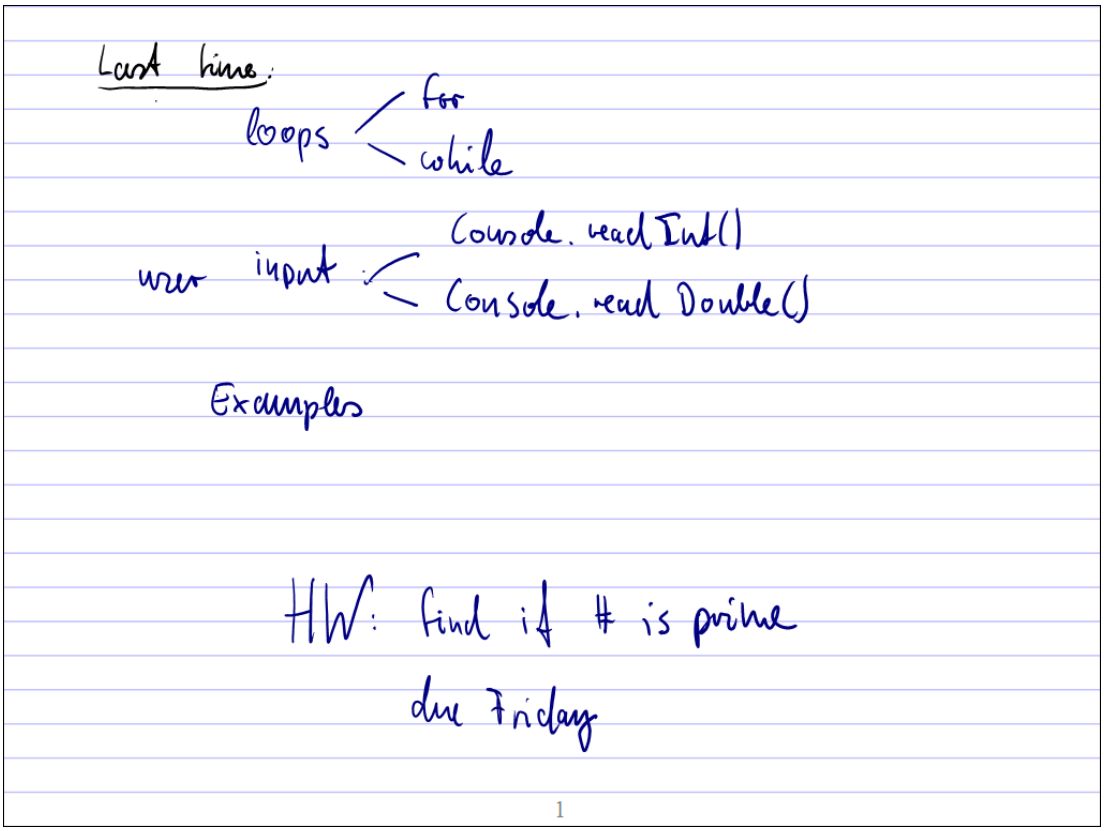
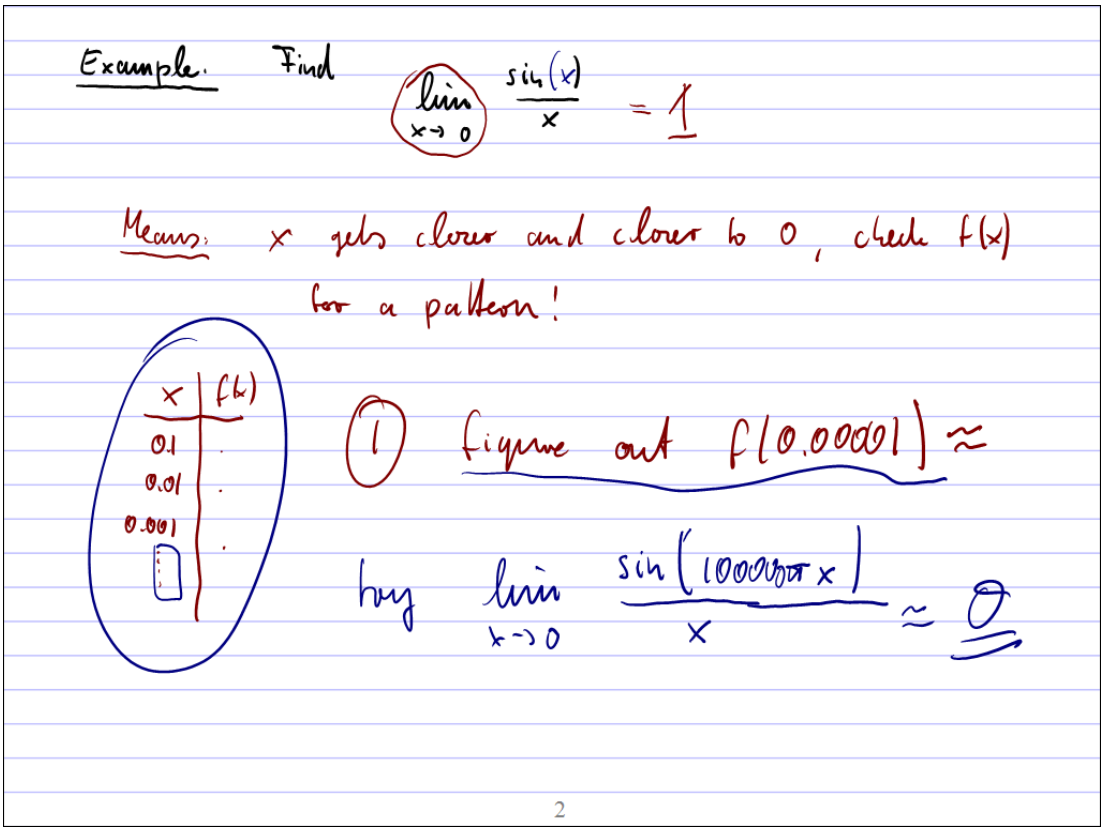
Panel 1



Panel 2



Panel 3

$$\lim_{x \to 0} \frac{\sin(1000000\pi x)}{x} = 1000000\pi \neq 0$$

```
public class Loopy
{
   public static void main(String args[])
   {
      for (double x = 0.1; x > 10E-10 ; x /= 10.0)
      {
         double y = Math.sin(100000*Math.PI*x)/x;
         System.out.println("f(x) = " + y);
      }
   }

}
```

work, but checks only positive x

3

Panel 4

Need:

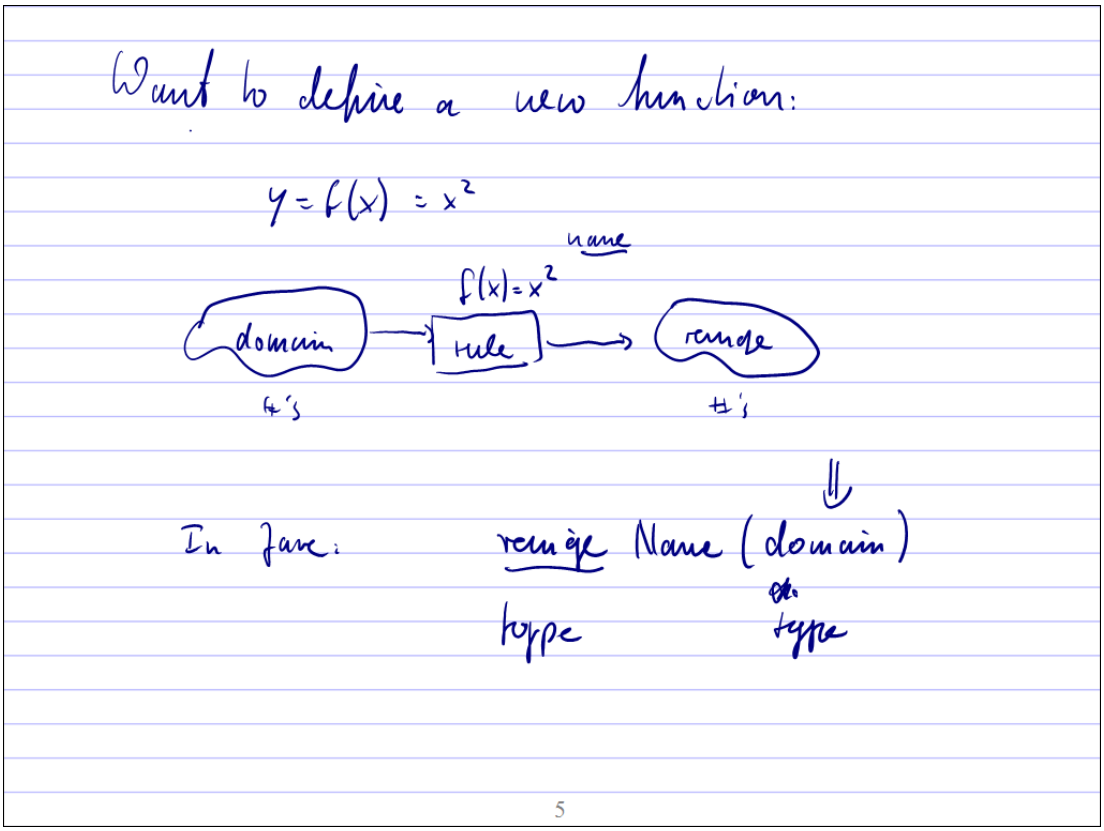
x	f(x)
0.1	
0.01	
0.001	
⋮	
-0.1	
-0.01	
-0.001	
⋮	

```
public class Loopy
{
   public static void main(String args[])
   {
      for (double x = 0.1; x > 10E-10 ; x /= 10.0)
      {
         double y = Math.sin(100000*Math.PI*x)/x;
         System.out.println("f(" + x + ") = " + y);
      }
      for (double x = -0.1; x < -10E-10 ; x /= 10.0)
      {
         double y = Math.sin(100000*Math.PI*x)/x;
         System.out.println("f(" + x + ") = " + y);
      }

   }

}
```

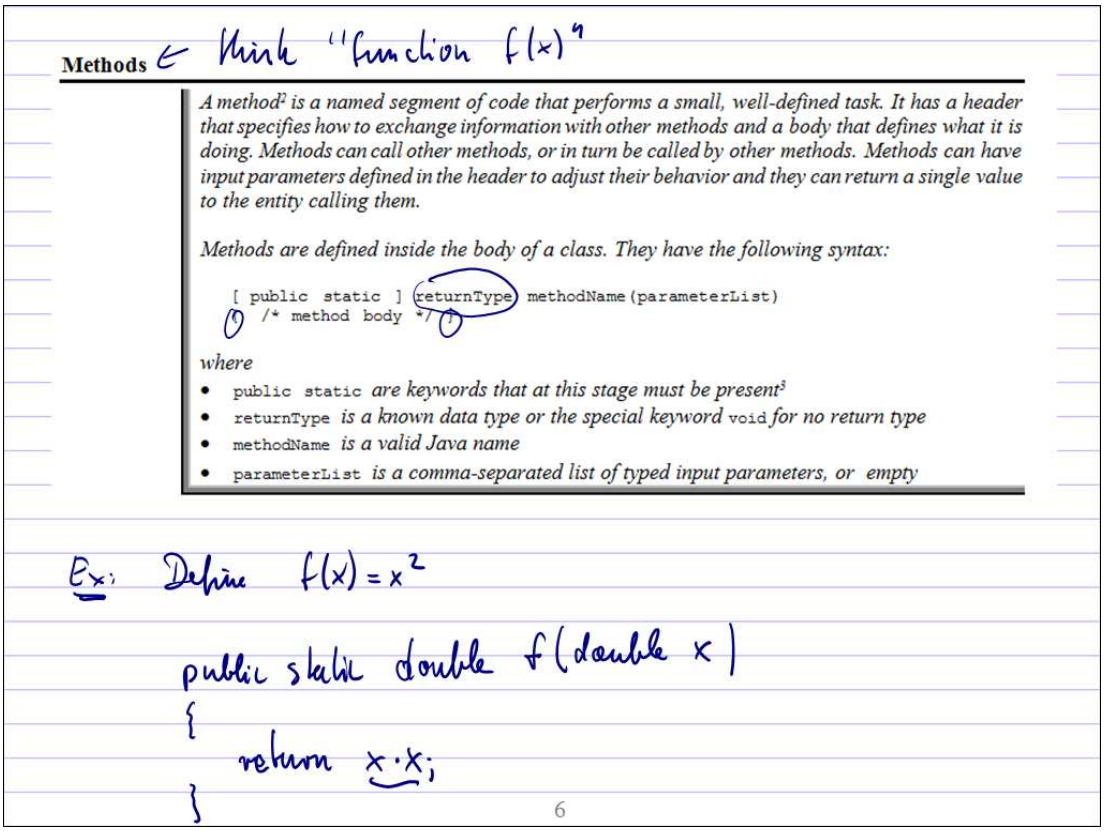
What if I want to use a different function!

4

Panel 5



Panel 6



Panel 7

```
public class Loopy
{
   public static double f(double x)
   {
      return x*x;
   }

   public static void main(String args[])
   {
      for (double x = 0.1; x > 10E-10 ; x /= 10.0)
      {
         double y = f(x);
         System.out.println("f(" + x + ") = " + y);
      }
      for (double x = -0.1; x < -10E-10 ; x /= 10.0)
      {
         double y = f(x);
         System.out.println("f(" + x + ") = " + y);
      }

   }
}
```

$\cos(x) - 1 \;/\; x \cot(x)$

find $\lim_{x \to 0} \frac{\cos(x)-1}{x \cdot \cot(x)} =$

7

Panel 8

(Math.cos(x)-1) /(x/Math.tan(x))

$\frac{\cos(x)-1}{x \cdot 1} \cdot \frac{1}{\tan(x)}$

Can I use program to find

$\lim_{x \to 0} f(x)$, $f(x) = \begin{cases} x^2+1 & \text{if } x > 0 \\ \sin(x) & \text{if } x \leq 0 \end{cases}$

8

Panel 9

Sophisticated example: Solve $f(x) = 0$, where f is continuous

i.e. solve $x^2 - 4 = 0$ $x = \pm 2$ ✓

solve $x^5 - 4x + 1 = 0$ $x = ???$ no clue!

Ex: Show that $x^4 - 2x - 1 = 0$ has at least one solution in interval 0 to 2.

Intermediate Value theorem:

$f(0) = -1 < 0$

$f(2) = 11 > 0$

by IVT there is a value s.t. $f(c) = 0$

9

Panel 10

$f(x) = x^4 - 2x - 1$, on $(0,2)$

$f(0) < 1$, $f(2) > 0$ best guess: $x = 1$ (middle)

$f(1) = -2 \neq 0$ too bad.

$f(1) < 0$, $f(2) > 0$ best guess: $x = 1.5$ (middle)

$f(1.5) = 1.06 \neq 0$ too bad

$f(1.5) > 0$, $f(1) < 0$ best guess: $x = 1.25$

$f(1.25) = -1.05$ best guess: $\frac{1.25 + 1.5}{2}$ = middle

Keep going next time!

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